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EXAMINER	
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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 10/541,457  
Filing Date: July 06, 2005  
Appellant(s): SUGITATSU ET AL

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SUGITATSU ET AL  
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed 3 April 2008 appealing from the Office action mailed 27 September 2007.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings that will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

No amendment after final has been filed.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct. The Notification of Non-Compliant Appeal Brief mailed 6 June 2008 has been withdrawn.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

5,567,224	KUNDRAT	10-1996
6,592,649	KIKUCHI ET AL	07-2003
6,755,888	IBARAKI ET AL	06-2004

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6,270,552	TAKEDA ET AL	08-2001
5,730,775	MEISSNER ET AL	03-1998
Pgs 5-23-5-32	Perry's Chemical Engineer's Handbook	No month-1997

**(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kundrat (U.S. Pat. No. 5,567,224), or Kikuchi et al (U.S. Pat. No. 6,592,649), or Ibaraki et al (U.S. Pat. No. 6,755,888) alone or in view of Takeda et al (U.S. Pat. No. 6,270,552) in view of Meissner et al (5,730,775) and Perry's Chemical Engineers' Handbook.

Kundrat discloses a method for reducing metal oxide in a rotary hearth furnace wherein a mixture of metal oxide and carbonaceous reducing agent is placed on the upper surface of the hearth and the metal oxide may be chrome ore, chromium ore concentrate or stainless steel flue dust (abstract). Kundrat teaches that the mixture of metal oxide and reductant is placed in a layer upon the hearth and heated to a temperature of at least 1000 °C, more preferably at least 1200 °C, before a second layer of carbonaceous reductant is placed over the mixture. The reason for heating the mixture first is that the second layer can be insulating, causing ineffectual heating of the mixture in the rotary furnace (column 4, lines 19-40). Kundrat discloses that the layer of mixture should be no greater than 40 mm and preferably less to minimize the time required for heating the mixture (col. 8, lines 38-65), which examiner contends will result in rapid heating. Kundrat teaches that the heating is by radiation (col. 8, lines 1-26).

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Kikuchi et al disclose a method for reducing a mixture of an iron oxide containing raw material with a carbonaceous reducing agent such as coke (abstract), where the iron oxide source material includes chromium oxide in addition to iron oxide (column 11, lines 34-53). Kikuchi et al disclose two heating steps including solid reduction that is done preferably at a temperature between 1200 to 1400 °C, and then the temperature is raised to between 1400 to 1500 °C to melt and coalesce the metallic iron nuggets (column 7, lines 38-53). The examples teach that a rotary hearth type furnace is charged with a 20-mm thickness of a mixture of iron ore and carbonaceous reducing agent, and then the temperature is rapidly raised to 1100 °C (column 13, line 42 to column 14, line 5).

Ibaraki et al disclose a method of reducing metal oxides in a rotary hearth type furnace (abstract), where a carbon containing powder is mixed with powders of iron and chromium ore as well as waste products from iron and steel production (column 7, lines 14-30). The mixture is pelletized and fed to a hearth of a rotary hearth furnace where the pellets are spread across the hearth and quickly heated at temperatures of 1100 to 1300 °C, where iron reduction reaches 95% or higher and chromium reduction reaches 50% or higher (col. 1, line 59 - col. 2, line 16). Although Ibaraki et al do not teach that the heating is by radiation as in instant Claim 1, the examiner contends that this would be the case in a moving hearth furnace and in the absence of evidence to the contrary.

Alternatively, Ibaraki et al do not teach that the rapid temperature rise in the mixture is caused by radiation heating.

Takeda et al disclose a method for reducing a layer consisting of a mixture of oxides such as iron ore and solid reducing material in a rotary traveling hearth and reducing the oxides

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through radiant heat transfer from above the hearth (abstract). Takeda et al teach that in a rotary furnace, the furnace hearth and body are lined with refractory and burner(s) act as a heat source in the upper part of the furnace reducing the solids on the lower hearth portion by radiation heating (column 1, line 21 to column 2, line 31).

One of ordinary skill in the art would, therefore, have expected at least one heat transfer mechanism in Ibaraki et al to be radiant heat, since the process is as disclosed by Takeda et al, wherein the heat transfer mechanism is radiant heating.

Kundrat or Kikuchi et al or Ibaraki et al alone do not disclose that the average rate of raising the temperature of the mixture in the reducing step is 13.96 °C/min or higher from the initiation of the radiation until the mixture reaches 1114 °C.

Meissner et al disclose a method for producing direct reduced iron from dry compacts of iron oxide and carbonaceous material (abstract). Compacts are exposed to a radiant heat source in a rotary hearth furnace preheating zone (column 1, lines 10-15). Results presented by Meissner et al demonstrate that the higher the temperature of the radiant heat source, the faster the compacts reach metallization goals, and thus, productivity can be increased (col. 5, lines 1-21). While Meissner et al do not equate the higher temperature with increased heating rate, one of ordinary skill in the art would have recognized that the rate of radiant heat transfer in a furnace is strongly affected by temperature ( $T^4$ ) as taught by Perry's Chemical Engineer's Handbook (p. 5-23 to 5-32). Meissner et al, therefore, demonstrate that the temperature of the radiant heat transfer source is a result effective variable which is varied to affect the time required to achieve metallization goals and improve productivity, and Perry's Chemical Engineer's Handbook teaches that increasing the temperature of the radiant heat source increases

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the heating rate as a function of  $T^4$ . It would have been obvious to one of ordinary skill in the art at the time the invention was made to have adjusted the radiant heat source temperature as a result-effective variable in the process of Kundrat or Kikuchi et al or Ibaraki et al alone or in view of Takeda et al, therefore adjusting the rate of heating to affect the time required to achieve metallization goals and thereby increase productivity as taught by Meissner et al (see MPEP § 2144.05 II B).

With respect to claim 7,

- a. Kundrat discloses that carbonaceous powder is charged to the furnace (col. 4, lines 19- 40), which examiner contends is a carbonaceous atmosphere-adjusting agent; or
- b. Kikuchi et al disclose that carbonaceous material is charged as discussed above regarding Claim 1; or
- c. Ibaraki et al disclose that carbon powder is charged to the furnace (col. 7, lines 14-30), which examiner contends is a carbonaceous atmosphere-adjusting agent.

Claims 3, 4 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kundrat or Kikuchi et al in view of Meissner et al and Perry's Chemical Engineers' Handbook as applied to Claim 1.

Kundrat or Kikuchi et al in view of Meissner et al and Perry's Chemical Engineers' Handbook is applied as discussed above regarding Claim 1. With respect to Claims 3 and 8:

- a. Kundrat teaches reducing at 1350 °C (col. 6, lines 50-55) which is within the claimed range of from 1250 to 1400 °C (claim 3) or 1300 to 1400 °C (claim 8), or

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- b. Kikuchi et al, example 1 discloses that the reduction step is performed at about 1350 °C (col. 13 lines 1-5), which is within the claimed range of from 1250 to 1400 °C or 1300 to 1400 °C (claim 8).

With respect to Claim 4:

- a. Kundrat teaches further melting of the partially reduced chromite ore in a furnace and/or converter (Fig. 1 (16) and/or (18), col. 7, lines 35-40 and examples 1 and 3), or
- b. Kikuchi et al discloses that the reduced mixture is subsequently melted (col. 14 lines 1-10).

Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kikuchi et al in view of Meissner et al and Perry's Chemical Engineers' Handbook as applied to Claim 1.

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Kikuchi et al in view of Meissner et al. and Perry's Chemical Engineers' Handbook is applied as discussed above regarding Claim 1. Kikuchi et al disclose that, the reduced mixture is subsequently melted (col. 14, lines 1-10) then cooled and solidified (col. 14, lines 5-17) as in instant Claim 5. With respect to Claim 6, the temperature for reducing is about 1350 °C which is within the claimed range of from 1250 to 1400 °C, then is raised to about 1400 or 1460 °C for melting (col. 13, lines 1-5) which are within the claimed range of from 1350 to 1700 °C.

#### **(10) Response to Argument**

Appellant argues that the current invention increases the chromium reduction degree with the presently-recited temperature rise by radiation heating.

However, this increase in the chromium reduction degree is not claimed.

Appellant also argues that Meissner et al is non-analogous art with respect to Kikuchi et al, Kundrat and Ibaraki et al.

The examiner agrees that Meissner et al do not teach reducing iron oxide; however, both Ibaraki et al and Kundrat broadly teach chromium and iron oxides. Therefore, the use of a rotary or moving hearth furnace to reduce metal oxides is common to Meissner et al, Kikuchi et al, Kundrat and Ibaraki et al.

Regarding the declaration filed under 37 CFR 1.132, appellant further argues that the conditions under which Meissner et al teach heating is disadvantageous.

However, the position of the examiner is not to propose that the combination of Kikuchi et al, Kundrat and Ibaraki et al with Meissner et al would yield the same result as in appellant's invention, but that the temperature rate under these operating conditions is not obvious.

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Appellant also fails to provide an actual comparison of temperature rates that would demonstrate the criticality of 13.96 °C/s.

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/T. M. M./

Tima McGuthry-Banks

Examiner, Art Unit 1793

22 July 2008

Conferees:

/Roy King/

Roy King

Supervisory Patent Examiner, Art Unit 1793

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